Space Weather Technical Forecast

Issued on Monday, 16 October 2023 at 13:24 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

---

Space Weather Forecast Headline: Chance of G1 on Day 3 (18th Oct). Rising Chance of R1.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity recorded at GOES 16 and 18 was Low in the past 24 hours, with occasional low-level C-class flares, peaking with a long duration C7.5 at 16/1051UTC from AR3467 in the northeast. A CME may be associated with this flare.

There are now up to seven sunspot regions. The largest group is AR3465 in the northeast, while its leading spot is growing the trailing region has almost completely disappeared. There has been very little development across the disc. All regions are magnetically simple and stable.

No new Earth-directed CMEs were observed though any CME from the LDE C7.5 flare will be analysed later.

Solar Wind / Geomagnetic Activity: Solar winds, as measured by DSCOVR at L1, suggested an exit from the tail of the fast wind from CH58/- into a slow regime, with the phi angle mainly negative (towards the Sun) through the period.

The solar wind speed showed a continued decline from early Slightly Elevated highs around 410km/s, eventually reaching 350km/s. The solar wind density was steady at Background levels in single figures ppcc throughout, while the IMF was similarly unremarkable at Background levels below 4nT, with the north-south component ranging between +3 and -3nT.

The net result of the above solar wind measures was for Quiet (Kp 0-2) geomagnetic activity throughout.

Energetic Particles / Solar Radiation: GOES16 high energy (greater than 10MeV) proton flux was at Background levels.

GOES16 high energy (greater than 2MeV) electron flux was at Normal Background to Moderate levels. Associated 24-hour fluence was well below the Active (1e8 integrated pfu) threshold. The observation at 16/0001UTC was 1.58e6 integrated pfu.

Four-Day Space Weather Forecast Summary

Solar Activity: There is a slightly rising Chance of M-class flares at first in the four-day period as a result of potential returning regions.

Solar Wind / Geomagnetic Activity: CH60/+ should arrive during Day 1 (16 Oct), bringing a Slight Chance of G1. Up to two CMEs then feature in the forecast, both low confidence and both glances, but potentially arriving during Day 3 (18 Oct), and giving a Chance of G1, probably with a preceding lull in activity as the CH60 fast wind declines.

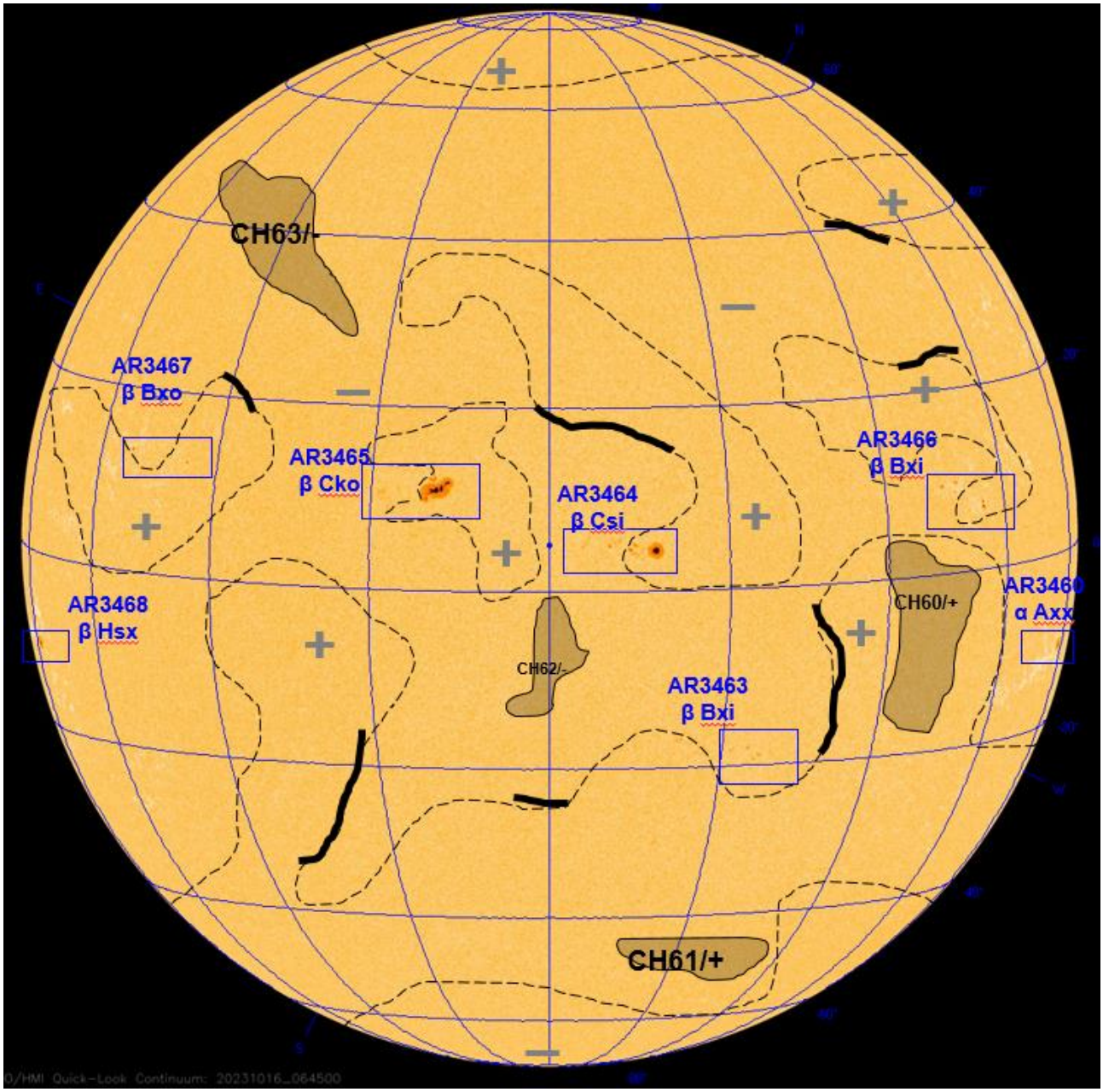
Energetic Particles / Solar Radiation: High energy (greater than 10 MeV) proton flux will most likely remain at Background levels.

High energy electron flux (greater than 2MeV) should now show a slight rise at first, but will probably be attenuated at GEO by the arriving fast wind. A more uncertain recovery is then expected through Days 3 and 4 (18/19 Oct), complicated by the possible passage of up to two transients.

Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

© Crown Copyright 2023. All Rights Reserved.

Figure 1. Solar Analysis Valid 16/0700 UTC.



.

Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

© Crown Copyright 2023. All Rights Reserved.

Geomagnetic Storms:

Earth is now considered to have departed the fast wind from CH58/-. The forecast therefore comprises the coronal hole fast wind from CH60/+, and up to two CMEs.
The coronal hole forecast is low confidence. CH60/+ is a narrow southern disc feature extending from mid-latitudes to the solar equator. Despite this geometry, MOSWOC Enlil appears to show any fast wind missing well to the south of Earth, which is considered improbable. Furthermore the persistence-based forecast is contaminated by CME effects on the last rotation, limiting its utility. Due to the positive polarity of CH60 and the time of year, there is considered a Slight Chance for the period of G1, most likely either late Day 1 (16 Oct) or early Day 2 (17 Oct).
There are also up to two CMEs with potential Earth-directed components due Day 3 (18 Oct). The first is from a corona-based dimming near N35W030 starting around 14/0340UTC. This has been modelled as delivering a possible glancing blow of Earth later in the UTC morning of Day 3 (18 Oct). Secondly, a CME was observed from a dimming and subsequent EUV filament channel north of AR3466 at 14/1240UTC, around N15W025. Given a similar inbound speed and emission longitude, this CME may add to or very closely follow the above CME glance, perhaps reaching L1 concurrently or closely behind its stablemate.
Overall there is a Slight Chance of a G1 intervals on Days 1 and 2 with a Chance of G1 on Day 3. Conditions will perhaps be most reliably Quiet by Day 4 (19 Oct) in the absence of further drivers of activity.

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	20	20	30	10
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Geomagnetic Activity - Earthbound Coronal Mass Ejections

Date/time 21.5R (UTC)	Halo: Full or Partial	Source	Source Location	Estimated Speed	Estimated Arrival Time	Comments
14/1337	Partial	Filament	NW	448 km/s	18/1100UTC	Low confidence glancing blow.
14/2152	Partial	Filament	NW	431 km/s	Similar	Low confidence glancing blow.

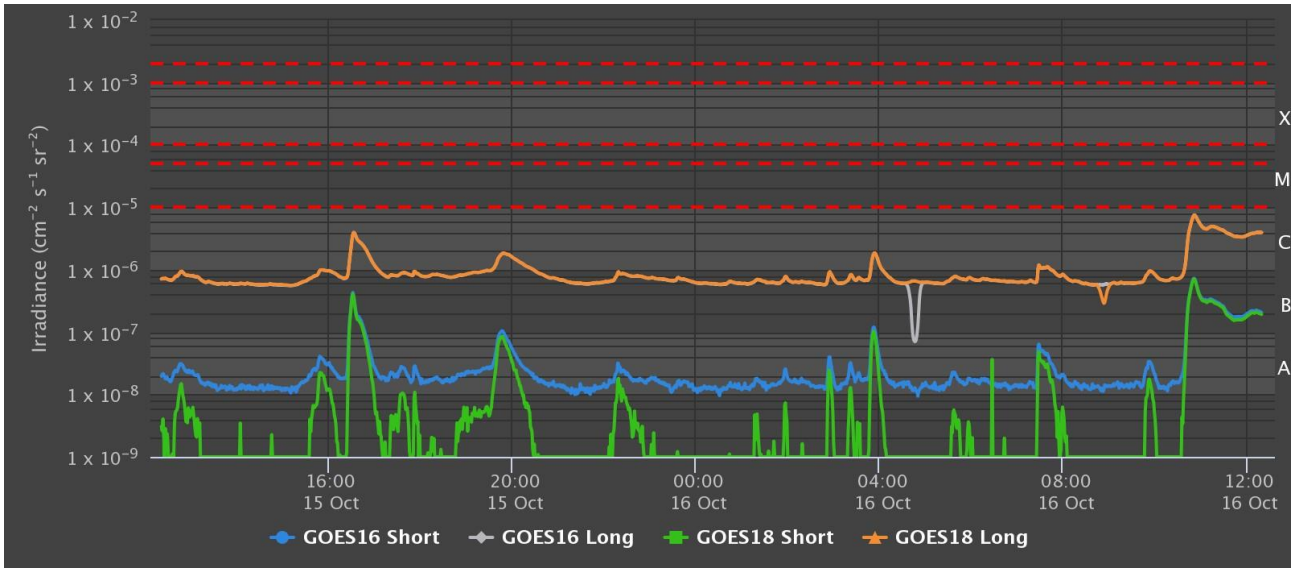
Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

© Crown Copyright 2023. All Rights Reserved.

Radio Blackouts - X-Ray Flares:
Low activity is expected, with only seven small and relatively simple sunspots currently on the visible disc. The main potential for increasing activity is from AR3464 near the centre or AR3467 in the northeast.
EUV imagery suggests there remain a few sunspot regions yet to fully rotate onto the disc, with some recent CME activity perhaps related from the southeast, and with some minor northeast limb flares observed in recent hours.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	No	25	30	30	30
Very Active	R3 to R5 X Class	No	1	1	1	1

Figure 2: GOES16/GOES18 X-Ray flares



Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

© Crown Copyright 2023. All Rights Reserved.

Solar Radiation Storms - (High Energy Protons):

The high energy (greater than 10MeV) proton flux observed by GOES16 is most likely to persist at Background levels. Any increase to proton flux is unlikely, given the current visible disc sunspots.

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	≥ S1	No	2	2	2	2
Very Active	≥ S3 *	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

High Energy Electrons Event (≥ 2MeV):

The electron forecast is relatively low confidence for the period as a whole. This is in part due to the dissimilarity of coronal holes versus last pass, but also because of their close succession (especially recent delayed CH58/- and impending CH60/+) and the presence of possible CMEs. To this end, MOSWOC REFM is not felt to offer anything other than a general trend, which is currently forecasting levels well below Active (1e8 integrated pfu).

The recent mainly Normal Background diurnal oscillation in flux at GEO should react upwards in the first 24 hours, but may be attenuated by geomagnetic activity arising from CH60/+ before the fluence troubles the Active threshold. The wake of CH60/+ ought to offer more favourable conditions for realising Active, however either of the pair of inbound CMEs will likely serve to interrupt and redistribute electrons before any lasting rise is seen.

Overall, a rising Chance of Active fluence is the preferred forecast for the four days as a whole, with flux levels more stable to end the week than starting it.

GEO Electron Environment Probability (Exceedance)	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	≥ 2 MeV ≥ $1x10^8$	No	1	20	30	30
Very Active	≥ 2 MeV ≥ $1x10^9$	No	1	1	1	1

Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

© Crown Copyright 2023. All Rights Reserved.